MAY 30, 1983

CHEMICAL & ENGINEERING

NEWS

Synthetic fibers lead way in chemical industry recovery
A Key Polymers Review Page 11

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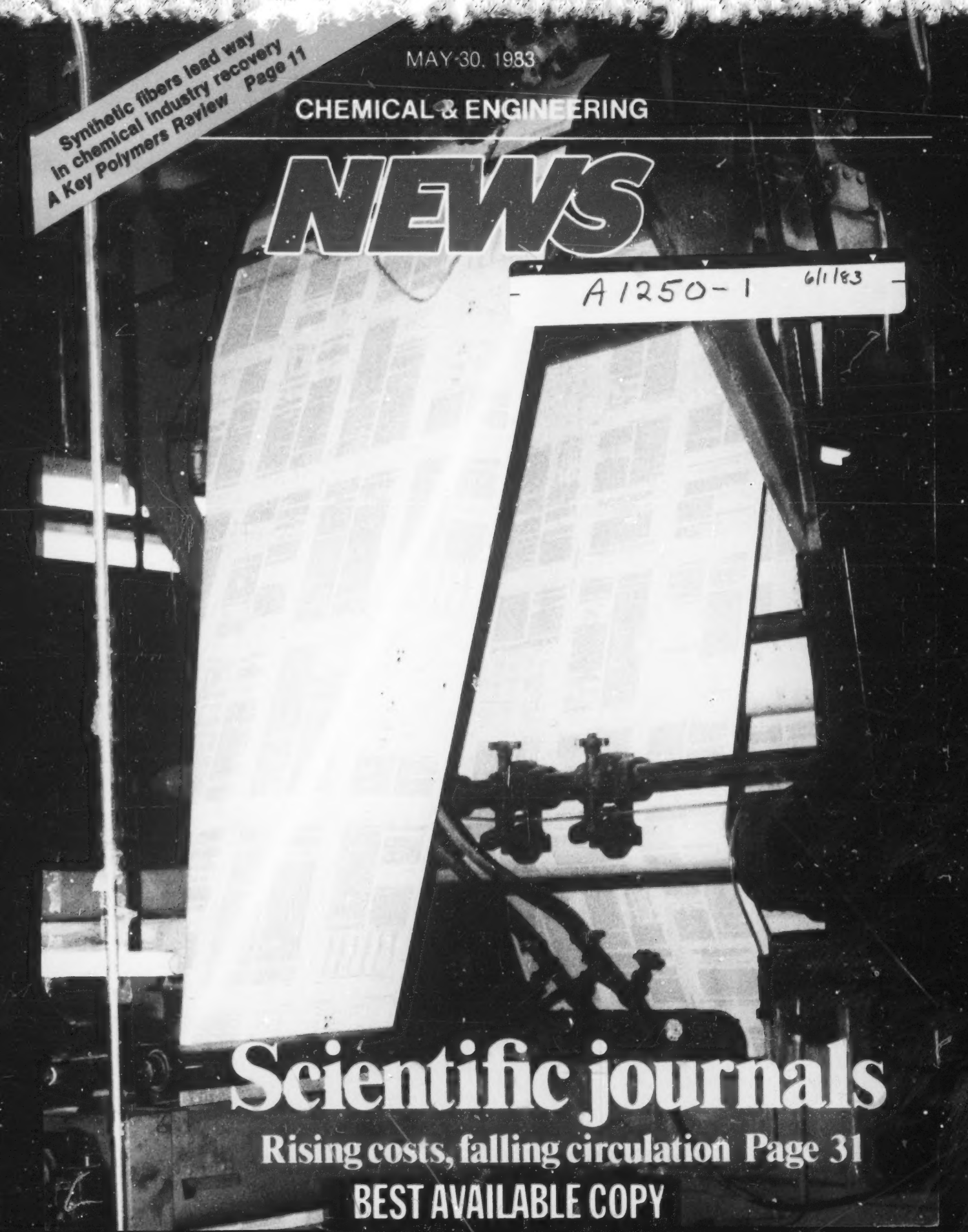

Scientific journals

Rising costs, falling circulation Page 31

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Cover: A chemical journal threads through printing press at Mack Printing Co., Easton, Pa. Photo by C&EN's Ernest L. Carpenter

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CHEMICAL & ENGINEERING NEWS

MAY 30, 1983

News of the Week

■ **Chemical solar cell developed by Standard Oil (Ind.) is much more efficient than earlier cells.** **Page 6**

■ **National Medal of Science given to eight who work in chemistry or related fields.** **Page 7**

■ **Celanese buys out partner ICI's share of Fiber Industries.** **Page 7**

■ **GE's electric power generator using superconducting magnets tested successfully.** **Page 8**

■ **Environmental regulations are not the top consideration in siting new plants.** **Page 8**

■ **George E. Heinze elected to ACS Board as Region III director.** **Page 8**

Business

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Education

Two programs set up to improve science education—Harvard will train midcareer scientists to teach; Wisconsin proposes institute to foster research in chemical education issues. **Page 30**

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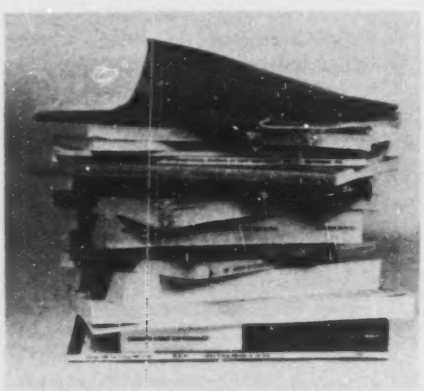


Special Report

Falling circulation, rising costs of paper, production, postage plague publishers of scientific journals. **Page 31**

Major Synthetic Fibers Well Into Long-Awaited Recovery

Markets could even get tight for some grades, as polyester, nylon, and acrylic move briskly out of the recession; imports still may be problem

Bruce F. Greek, C&EN Houston

U.S. synthetic fiber producers have been quietly convinced ever since the late 1970s that their day in the sun wasn't far away. Although the stop-and-go recession of the past three years kept that day from arriving, 1983 and 1984 could bring it in.

Of course, with the tricky fibers market, all forecasts have to be in the conditional. In the past, prosperity time and again has touched fibers for a year or two only to vanish in five to 10 years of turmoil. That's what happened after the early 1970s bonanza. For the rest of the decade, major fibers went through a numbing round of plant closings, poor growth, and financial distress.

But fibers people think they have paid the price now and will get something better. Evidence so far this year bears them out. And if they're right, it's good news for the entire chemical industry. Fibers traditionally are a leading-indicator product group.

At the moment, resurgence in fibers demand continues after a fitful start late in 1982. For some fibers, the rebound is building good strength and likely will carry into 1984. That would bring production to above the levels of 1981, the last good year for this $6.6 billion segment of the chemical industry. Variations still will exist in the fortunes of the different polyester, nylon, and acrylic grades covered in the following pages. Some are well ahead of the averages, and some lag.

It all depends on which markets are involved. Fibers with the best current prospects are going heavily into home furnishings, where demand is spurred by the large upturn in housing starts this year. Apparel uses rank second in the market outlook for the next few years. Here, inventory-cutting has been completed, and new inventories held down. For polyester, a good increase in apparel-related export markets is likely.

Key Polymers

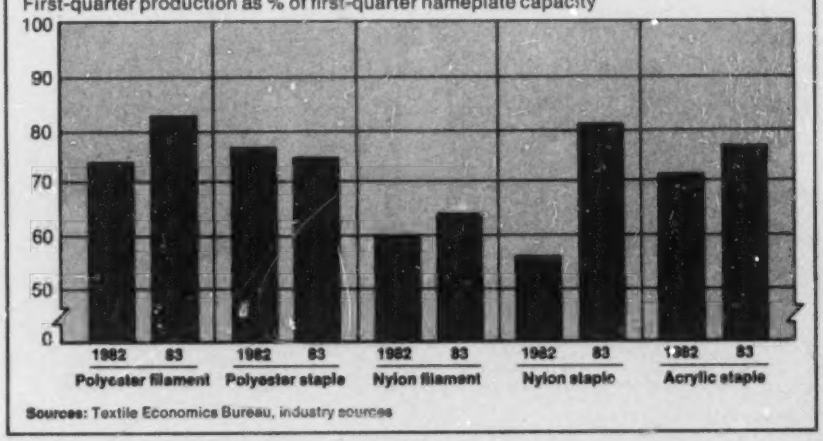
These recovery prospects will make the fibers business a better money maker. The largest fibers producer, Du Pont, already reports higher fiber profits in the first quarter, rising 38% on a 4% sales gain. Similarly, Celanese reports that its U.S. polyester profits nearly doubled in the first quarter from early 1982. Monsanto comments that fiber volume, demand, and shipments were better in the quarter than a year ago. Allied comments that sales increased significantly in carpet fibers, contributing to an 86% profits gain in the company's combined chemicals and polymers business.

As production grows, higher plant operating rates are assured because no capacity additions of any size are in the works for the next two years. For some forms of the three large-volume fibers, capacity has all the earmarks of becoming tight later this year and beyond.

Actually, fiber capacity has been slipping gradually for many years. Most of the recent decline has been in polyester, but nylon also has been hit. Unless another severe recession comes along, however, analysts expect that capacity will just about hold at present levels through the rest of the decade.

Combined production of the three major fibers could total nearly 6.5 billion lb in 1983, up 14% from 1982

Plant use in polyester filament and nylon staple pushes over 80%



Sources: Textile Economics Bureau, industry sources

but still below 1981's 7.2 billion lb. At the current clip of monthly shipments increases, 1984 production could easily exceed 1981 levels. These fiber data are current estimates from industry sources and past figures from the Textile Economics Bureau.

Capacity use this year could be close to 80% of the combined first-quarter nameplate total. This is well above 1982, when capacity use fell below 70%, even without counting polyester capacity shut down during the year. If 1984 brings out another 1 billion lb of fiber production, plants will have to run well above 90% of capacity, bringing back the boom conditions of the early 1970s.

Already, the improved level of plant operations has led to a sharp drop in fibers' ratio of inventories to shipments. The rule of thumb here is that, under normal business conditions, companies should keep about a one-month supply of product in stock. More than that tends to mean oversupply, and less means a tightening market. Over the past year, inventories have dropped from a four- to five-week supply to a bit more than three. In one of the more dramatic examples, the ratio for nylon staple has tumbled from 1.19 to 0.80. Capacity use has jumped from 56% to 81%. This nylon type, which goes heavily into carpets, is well on its way toward a sellers' market.

Firming up prices for these fibers is very much on producers' minds. Price hikes might well be expected amid rising production, but for fibers, there have been too many cases of profitless prosperity as in the 1970s. Producers pushed to keep sales volume up at the expense of price increases.

So far in 1983, too, most of the gain in fiber value has come in physical volume instead of price. In 1983, sales value of the three major fibers probably will exceed $6.6 billion, up 12% from $5.9 billion in 1982. With minor price increases and a substantial volume increase in 1984, sales value certainly will exceed 1981's $7 billion.

But there could be a catch. Higher fiber prices could put a damper on production if price hikes hurt U.S. apparel manufacturers in their all-out competition with imports. Even fiber exports (some of which return as clothing) could decline if they become uncompetitive with fibers from Europe, Japan, or developing countries.

There is an unfortunate analogy to the U.S. steel industry. Steel costs rose so much that imported steel grew from negligible to very sizable. Steel outlets such as automobiles also became more expensive, and foreign autos garnered a quarter or more of the U.S. market. In the same way later this decade, markets for apparel and other finished goods made from fibers may be wrested away by imports. The large share of the acrylic sweater market currently taken by imports could be a sign of things to come.

Higher fiber prices also could hurt synthetic fibers in their competition with natural fibers. In some cases, such as carpets, synthetic fibers have literally taken over and are considered quite safe from competing inroads. However, apparel markets are another matter. There's always a threat hanging over them from natural fibers, especially cotton.

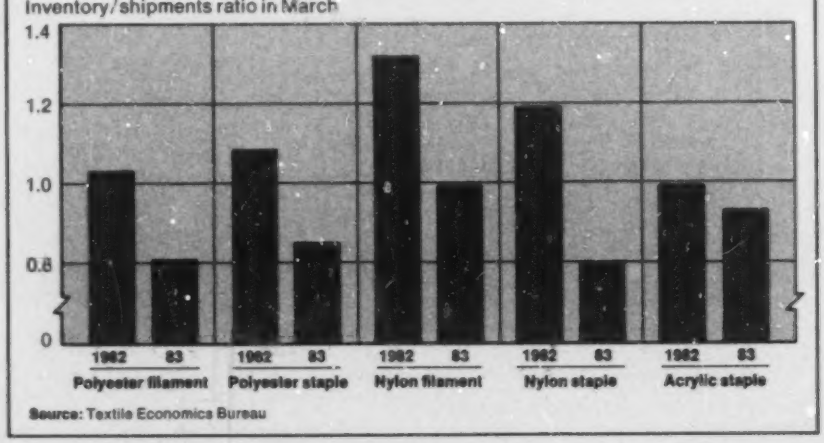
The biggest tussle is between cotton and polyester. The cotton price bounces around, influenced by weather, politics, fashion, and other highly unpredictable factors. This year the cotton price is high, with cotton futures priced even higher. Experts expect further increases, although not to the levels of 1980 and 1981. They add that this price rise may continue through the 1980s as cotton farmers find cattle and soybeans more profitable. This augurs well for synthetic fibers, especially polyester.

But again, higher cotton prices, coupled with higher demand and prices for polyester, will make U.S. apparel markets more attractive to imports, especially from developing countries that want the jobs in labor-heavy textiles. So the economic balance wheel may swing toward easing demand for U.S.-produced polyester.

Some apparel imports will be made from U.S. fiber exports. However, these would hardly offset the imports' impact on U.S. fiber demand. A typical result is the current controversy involving China, which radically reduced polyester imports from the U.S. in 1982 in response to U.S. restrictions on clothing imports. Negotiations are under way to resolve the impasse. Polyester producers wish for success here because their forecasts depend on increased exports, a good bit of which would go to China. On that assumption, analysts say polyester exports could exceed 500 million lb this year or one seventh of estimated production.

At home, the smaller-volume industrial uses of synthetic fibers often have been the frosting on the cake, but lately the frosting has been thin. Tire cord, a large outlet, is the problem. Changes in tire cord favoring steel and the rise in auto imports combine to make the outlook for industrial fiber uses one of minor growth. The business recovery will help now, but a return to 1981 levels may take some time.

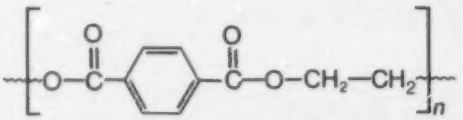
Fiber inventories have tightened drastically over past year



Source: Textile Economics Bureau

Key Polymers

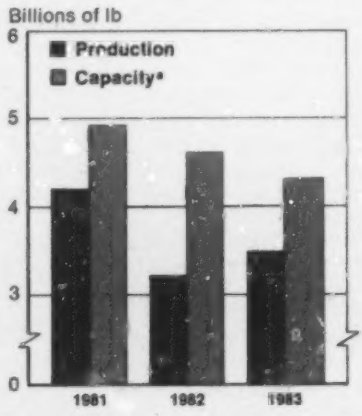
Polyester



Poly(ethylene terephthalate)

- ***Demand well up***
- ***Capacity down***
- ***Prices up a bit***

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Reaction of dimethyl terephthalate or terephthalic acid with ethylene glycol to produce bis(2-hydroxyethyl)-terephthalate, which is catalytically polymerized to poly(ethylene terephthalate)

MAJOR END USES (U.S.)

Apparel 60%, home furnishings 20%, industrial uses 10%

FOREIGN TRADE

Exports—may reach 500 million lb in 1983; imports—small, may rise to 15 million lb in 1983

PRICES

150-denier textured filament 95 cents to $1.10 per lb; 150-denier feeder filament, 80 cents per lb; staple 85 cents per lb; variable discounts

COMMERCIAL VALUE

$3 billion for production, 1983

Predicting the fortunes of polyester fiber is one of the finer arts, since the picture includes everything from Chinese diplomacy to the boll weevil. Forecasts cover quite a range this year, but everyone agrees, the direction is up.

Polyester has begun recovery from a very bad 1982, when U.S. production fell a thumping 24% to 3.2 billion lb. Even a strong upturn in 1983 won't fully overcome that drop. Much depends on the shifting outlets of apparel and exports. The latter are hung up at the moment in trade negotiations between the U.S. and China. Analysts hope the China outlet will open up late in the year.

Of many different polyester forecasts for 1983, the majority look for about a 10% pickup in output to about 3.5 billion lb. Optimists envision a production increase of nearly 20% to 3.75 billion lb. Pessimists put the total down to 3.4 billion lb.

Plant capacity for polyester continued to decline in 1982 as in 1981. As 1983 opened, nameplate capacity was about 4.3 billion lb per year of the various fiber types. If production this year totals 3.5 billion lb, the average operating rate would come close to 82%.

However, there is quite a split in the capacity use situation. Plants making polyester filament (continuous yarn) currently are running at a higher rate than are plants turning out staple (chopped fiber). The textile filament part of the capacity is stronger yet compared to other types such as industrial monofilament. Because of this strength, filament producers apparently are succeeding in a price increase in early May—something that has proved quite difficult in recent years.

One reason a price hike has a better chance now is that polyester inventories are relatively snug. In both filament and staple, Textile Economics Bureau data show well under a one-month supply in storage at producers.

Apparel uses are behind the current surge in polyester filament demand. In 1983, this outlet might take as much as 1 billion lb of fiber, up from 800 million lb in 1982. There's strong potential for rebuilding demand in this area because in the economic downturn, apparel cost the fiber as much as 400 million lb in lost sales over 18 months in 1981 and 1982.

Apparel uses of staple also have picked up because of the improved economy and higher prices for competing cotton. Some analysts noted a turn in apparel demand for polyester staple at the start of fourth-quarter 1982. The shift has continued, allowing a big reduction in inventories and generally stable, though still discounted, prices.

The widely used blends of polyester staple with cotton and wool can be shifted by official label changes or by small fractions without changes in labeling. Such changes, because of the volume involved, can have a big impact on staple demand. For example, the government's agricultural payment-in-kind program designed to reduce planted acreage in 1983 will cut cotton production, already has raised cotton prices, and may cause an official shift toward the high end of the polyester-cotton ratio in shirts, dresses, and the like. However, analysts say it would take a major increase in the cotton price to cause an official ratio change because of the costs involved in new labels, machinery adjustments, and promotion. Even then, some observers doubt the success of high-polyester-content blends because of the sacrifice seen by many customers in esthetics and feel.

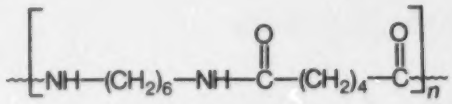
The smaller home furnishings market for polyester also is turning up in demand growth from the housing upswing. Current views are that the various uses in housing—carpets, bedding, draperies, and so on—all will increase, with carpets possibly the slowest. Bedding has done somewhat better because of energy saving concerns which have helped sale of comforters and blankets.

Industrial uses of polyester fiber will aid production less than will apparel and home furnishings. Tire cord consumption will do well just to hold level this year even with higher car production because of the shift to radial tires. Use of polyester in belts and other reinforcing applications also is not expected to grow much.

Overall, the outlook for polyester is the most variable of the major synthetic fibers. U.S. use will increase 10% or more if the economy continues its steady recovery. If exports to China get cracking later in 1983, production could get a considerable extra push carrying into 1984.

Key Polymers

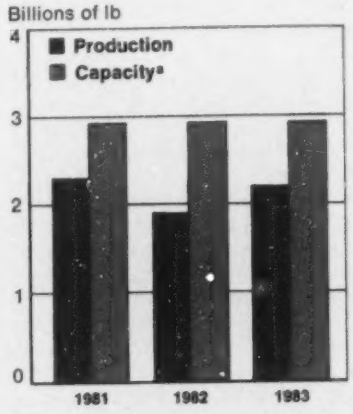
Nylon



Nylon 66

- ***Demand strengthening***
- ***Capacity flat***
- ***Prices firmer***

PRODUCTION/CAPACITY



[a] First quarter.

HOW MADE

Nylon 66—reaction of adipic acid and hexamethylenediamine to form hexamethylene diammonium adipate, which is polymerized by removal of water; nylon 6—polymerization of caprolactam by addition and subsequent removal of water

MAJOR END USES

Home furnishings 60%, apparel 25%, industrial uses 15%

FOREIGN TRADE

Exports—declining to about 100 million lb in 1983, imports—up slightly to about 25 million lb in 1983

PRICES

Carpet staple $1.15 to $1.20 per lb; apparel grades $1.80 to $2.40 a lb; some discounting

COMMERCIAL VALUE

$3 billion for production, 1983

In the popular mind, nylon is associated with clothes. But actually, the nylon market is heavily weighted toward construction, which takes about 60% of production in carpets and other uses. This year, that's good; but last year, it wasn't. So nylon has a strong recovery in progress and stands to gain more than any other major fiber from the big pickup under way in big-ticket U.S. consumer durables.

In fact, nylon could make it back all the way this year from last year's drop, although most opinion isn't quite this optimistic. Analysts generally believe full recovery will wait until 1984.

Current thinking is that nylon production, including 66 and 6 types and aramid, probably will reach 2.2 billion lb this year, up at least 15% from 1982. Some analysts hold out hope for an extra 130 million lb of production, bringing the 1983 total to 2.33 billion lb. This high estimate still would be below the all-time high of 2.55 billion lb in 1979.

Plant capacity in nylon changes slightly each year, fluctuating around 2.9 billion lb. In 1983, for example, some capacity will close permanently at Du Pont. But this drop could be offset by debottlenecking at other plants and possible small-scale expansions for some of the specialty types.

With an average capacity estimate of 2.9 billion lb, the industry will operate at more than 75% of the nameplate total in 1983, up substantially from 66% in 1982. The 1983 operating rate could close in on 80% toward the end of the year.

Of the two major nylon types, there is more than twice as much capacity for nylon 66 (made from adipic acid and hexamethylenediamine) than nylon 6 (made from caprolactam). Differences in physical properties between these two are small enough that the fibers can be used interchangeably in most applications. There is a sharp producer split between the two, with Du Pont and Monsanto the powers in nylon 66, and Allied, Akzona, and Badische in nylon 6.

The big home furnishings market, dominated by carpet, provides nylon's major ups and downs. The decline in home building beginning in 1981 hit nylon especially hard with a combination of sales declines and inventory chopping. The decline in carpet use alone more than accounted for the decline in all nylon fiber shipments in 1982.

Now that home building has started to improve, the outlook for nylon is brightening rapidly, especially for staple. Although houses are smaller now, partly because of a higher fraction of multifamily dwellings, nylon carpeting is still growing in volume. Some of the reason is that new-home sales stimulate used-home sales, and buyers of old houses frequently replace carpets.

Other nylon uses in home furnishings are small. For example, the upholstery outlet is just a few per cent of carpet volume. It's making a good gain this year but can't have much effect on total nylon demand.

The apparel market, about a quarter of total U.S. nylon demand, also is growing briskly, especially for nylon filament. Fashion has a significant impact here. For example, the popularity of lightweight outerwear and sportswear at the moment has given nylon a nice growth market. Some apparel uses such as hosiery are old standbys, less affected by the economy and fashion but not expected to grow much either. A few small apparel uses such as sweaters are declining.

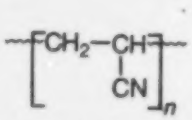
Industrial uses make up less than 15% of the nylon fiber consumption in the U.S. A big part of this outlet is tire cord, now mainly for off-the-road and/or oversized truck tires and specialty products such as aircraft tires. Passenger car markets for nylon have declined drastically with the explosive inroads of radial tires.

After a steady decline, nylon tire cord demand may have bottomed out, analysts believe, and could begin to grow again slowly. Use of heavy-duty tires depends on the general economy. With commercial and industrial construction currently lagging, a significant upturn for tires for construction equipment could be some time off. Other industrial uses in belting, hose reinforcement, webbings, luggage, and so on are small, and pickups in these uses won't help total nylon demand very much.

Fortunately, nylon doesn't have to wait for big new commercial construction projects or a new capital spending wave in industry. All nylon needs this year is continued vigor in housing.

Key Polymers

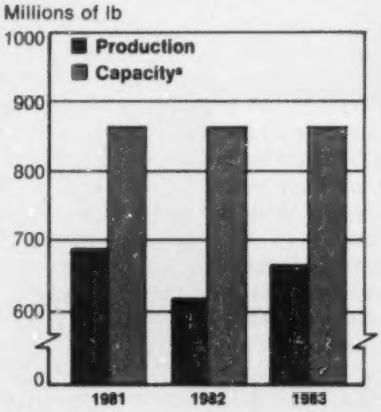
Acrylic



Polyacrylonitrile

- ***Demand improving***
- ***Capacity stable***
- ***Prices steady***

PRODUCTION/CAPACITY



* First quarter.

HOW MADE

Polymerization of acrylonitrile, which is made by catalytic reaction of ammonia and propylene

MAJOR END USES (U.S.)

Apparel 65%, home furnishings 30%, industrial uses 5%

FOREIGN TRADE

Exports—rising in 1983 to about 200 million lb, imports—holding at 10 million lb or less

PRICES

3-denier staple for apparel $1.00 to $1.10 per lb; discounting significant

COMMERCIAL VALUE

$600 million for production, 1983

Acrylic is a singular fibers business and sometimes goes its own way. It's the most apparel-oriented major fiber (65% of demand) and by far the most international, with exports taking 30% of U.S. production. Exports are expected to do well this year. However, acrylic can't cash in on the upsurge in U.S. housing so much as nylon can. The net result: Acrylic is expected to have a decent recovery but no boom.

As American Cyanamid pointed out in its first-quarter report, acrylic had a fast-rising start for the year. For now, acrylic analysts think the fiber will wind up 1983 with a moderate production increase after two years of decline. This improvement for a fiber somewhat in eclipse in recent years, especially in U.S. use, is good news to struggling acrylic producers. Longer term, if the production increase continues, one analyst ventures, acrylic fibers will be a good business providing acceptable profitability.

This year's production growth is forecast at 7 to 10%, bringing output to about 670 million lb. In 1982, production fell 10% to 620 million lb. The record was 780 million lb in 1980.

Total capacity for the various acrylic fiber types has plateaued near its peak of 860 million lb per year. It probably will hold here for some time except for the inevitable debottlenecking, which takes a while to appear in capacity estimates. The Textile Economics Bureau's official capacity listing is a slightly lower 830 million lb for late 1982.

For 1983, if production reaches 670 million lb, capacity use will average 78%. This is good for acrylic although not so high as expected for other major fibers. However, since acrylic has largely depreciated plants and little if any increase in feedstock costs, 78% operation suggests considerably better profitability.

But acrylic is not without problems. Middling capacity use stems mainly from a major wave of imports of finished acrylic clothing, which reduces potential acrylic fiber sale to manufacturers in the U.S. These imports aren't likely to go away soon.

True, the imports indirectly help U.S. acrylic fiber's important exports, which are forecast to zoom to about 200 million lb in 1983 from 127 million lb in 1982 and account for 30% of production. The rise in exports will be greater than the rise forecast for production, by 25 million lb or so. This hints another import-related drop in the U.S. outlet for acrylic. This outlet for U.S. producers has slumped about 30% from its peak back in 1973. In other words, exports are critically important to U.S. acrylic fiber growth.

As might be expected, imported acrylic clothing is the kind with relatively high labor costs, such as sweaters. By contrast, acrylic socks are made mainly in this country.

Imports of raw acrylic fiber have been falling, as might be expected from the size of unused U.S. plant capacity and consequent discounting of prices. Imports were down to a smallish 10 million lb in 1982 and are expected to hold at this level even with the improving U.S. market outlook.

Use patterns of acrylic fiber in the U.S. change little with time except for ups and downs in sweaters. High fashion changes from year to year, causing ripples in sweater demand. Currently, an upturn in demand for expensive U.S.-made acrylic sweaters is partly offsetting the market loss in lower-cost imported sweaters.

Another major area of acrylic apparel use which seems to maintain its position is "craft yarns" bought to be knitted into sweaters and other clothing items. These yarns require minimal labor in fabrication and distribution, thereby making imports very small. Craft yarns are roughly equal in market size with hosiery, sweaters, and pile fabrics.

Home furnishing uses of acrylic fiber are mainly in carpets and blankets, although there are many smaller uses. The economic recovery and home building upsurge are expected to boost demand for acrylic in furnishings relatively faster than in apparel but with less impact in terms of actual poundage.

Industrial uses of acrylic fibers are small. They range widely, from boat sails to filters.

With some help in industrial and housing uses this year and another nick in some U.S.-made textiles, acrylic will need every pound it can get in exports. At the moment, the overall data look good, and the fiber is becoming a much better business.